

Subject Area 5.1: Microbial studies and technologies supporting waste disposal, management, and remediation of municipal and industrial hazardous wastes

#### Research Article

#### Feasibility Assessment of Electrocoagulation Towards a New Sustainable Wastewater Treatment<sup>a</sup>

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Treatment of wastewater is a major challenge in our society.

**Abstract** Background. Aim and Scope. Electrocoagulation (EC) may be a potential answer to environmental problems dealing with wastewater treatment. This study focuses on the feasibility of EC-processes for industrial wastewater treatment. The aim was to evaluate the feasibility of EC-technology in terms of technical and economic factors. EC-technology claims to offer advantages over conventional methods such as precipitation and sedimentation, and without adding any precipitating agents.

**Materials and Methods.** Real wastewater from Steels onwards with high metal concentrations was used for the experiments. An EC setup with a Sebcon copper stirring and stirring complex, two iron electrodes and powered by a 40 A supply unit. Results concerning basic parameters were obtained by laboratory experiments and confirmed in real wastewater. Analysis of dissolved metal concentrations before and after treatment was performed by atomic absorption, confirmed by an independent test via IAA.

**Results.** Several aspects were taken into account, including cost-effectiveness, energy consumption, and energy savings throughout the process, in order to analyze all possible factors influencing the cost of the process. The results show that the energy consumption of the system is very low compared to other processes. Discharge limits, electrode configurations and data sheets on energy demand were discussed and exemplified based on fundamental concepts and models.

**Conclusion.** Based on conceptual data and since no engineering aspects were applied, the EC-process proved to be only feasible in the laboratory scale, but not for industrial wastewater treatment.

**Keywords:** *Aqueous chemistry, electrocoagulation, copper, dissolved metal, industrial wastewater treatment*

#### Introduction

Despite the fact that electrocoagulation (EC) technology was patented a century ago [1], the absence of any significant industrial application has been a major obstacle to its implementation. Given the world water crisis forecasted by UNDO and the World Water Council, there are reasons to believe that the EC-technology has the potential to become a major factor in responding in order to feed the world [2]. Therefore, the urgent need for sustainable solutions is recognized. While EC-technology offers great opportunities for wastewater reuse and reuse of treated effluents, it is discontinued to realize these benefits, mainly because of still certain usage limitations for cleaning purposes.

Furthermore, using renewable energy to operate EC-processes is considered to be a promising approach due to the electrical power from fossil resources. Since metallurgical wastewater treatment is one key aspect involving heteroflocculation and sedimentation, the interest in EC-technology in the few last years of DMF<sub>2</sub> provides an improvement to former attempts in this field. The drawbacks and opportunities of EC-technology for the treatment of industrial wastewater, including the neutralization and removal of heavy metals, within current discharge requirements as regulated by law,

#### 1. State of the Art

##### 1.1. Generalities

The basic principle behind electrocoagulation involves colloidal chemistry concepts, dealing with the formation, characteristics and modification of colloids. These particles are characterized by their size, ranging between the 1 nm to 1 μm range, are considered big enough to disregard quantum mechanical effects, but small enough to diffuse through membranes [3]. Therefore, the EC-process disperses colloidal particles through typical membrane filters or molecules which get absorbed by means of surface bound GH-groups, and thus it becomes easier to separate them from a solution.

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